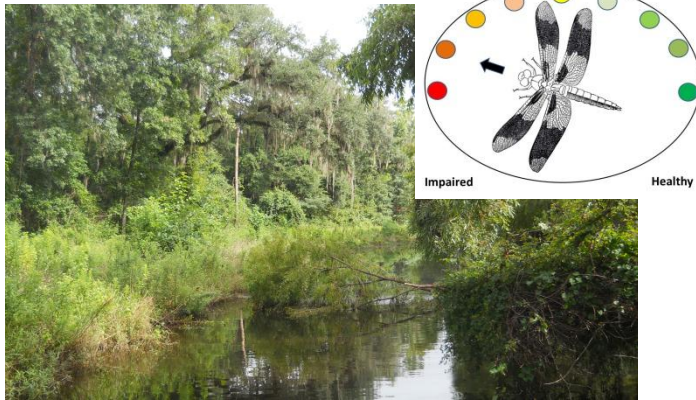


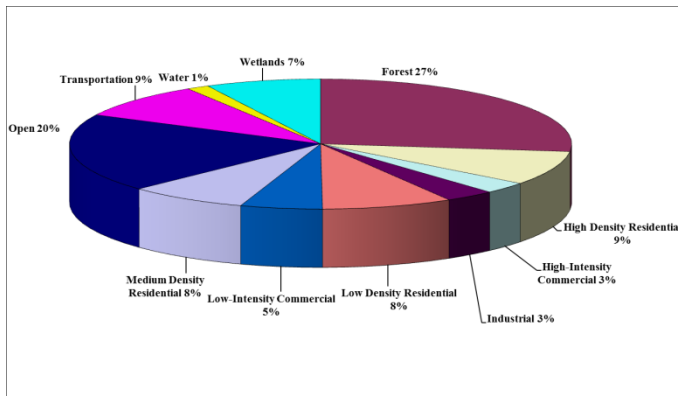
## Waterbody: Munson Slough



## Basin: Lake Munson

The heavily urbanized Munson Slough and its tributaries are located in central Leon County and drain a portion of the City of Tallahassee. The Slough flows south into and out of Lake Munson, then continues to Eight Mile Pond. After exiting Eight Mile Pond, the Slough flows under Oak Ridge Road and enters Ames Sink, which is known to be connected to Wakulla Springs.

As shown in the figure below, approximately 45% of land use in the 42,526 acre watershed is residential, commercial, industrial, or transportation. Increases in stormwater runoff, and waterbody nutrient loads can often be attributed to these types of land uses.



### Background

Healthy, well-balanced stream communities may be maintained with some level of human activity, but excessive human disturbance may result in

waterbody degradation. Human stressors may include increased inputs of nutrients, sediments, and/or other contaminants from watershed runoff, adverse hydrologic alterations, undesirable removal of habitat or riparian buffer vegetation, and introduction of exotic plants and animals. Water quality standards are designed to protect designated uses of the waters of the state (*e.g.*, recreation, aquatic life, fish consumption), and exceedances of these standards are associated with interference of the designated use.

### *Total Maximum Daily Load (TMDL)*

The Florida Department of Environmental Protection (FDEP) issued several TMDLs for Munson Slough including both upstream and downstream of Lake Munson. The TMDLs are as follows:

### *TMDLs upstream from Lake Munson*

The fecal coliform TMDL for portions of Munson Slough will require a 96.9 percent reduction at sources contributing to exceedances of the criteria where the Slough crosses under Springhill Road and a 91.5 percent reduction at the Slough where it crosses under Capital Circle southwest.

The dissolved oxygen TMDL targets are 5-day biological oxygen demand (BOD<sub>5</sub>) of 2.00 mg/L, total nitrogen (TN) of 0.72 mg/L, and total phosphorus (TP) of 0.15 mg/L and are allocated as follows. To meet the dissolved oxygen TMDL criterion, water chemistry concentrations will require a 50 percent reduction for BOD<sub>5</sub>, an 8.35 percent reduction for TN, and a 17.53 percent reduction for TP at sources contributing to exceedances of the TMDLs.

### *TMDLs downstream from Lake Munson*

The dissolved oxygen TMDL is an in-stream concentration for BOD<sub>5</sub> of 2.00 mg/L and is allocated as follows. In-stream concentrations must meet the dissolved oxygen criterion and BOD<sub>5</sub> TMDL concentrations will require a 52.9 percent reduction at sources contributing to exceedances.

The un-ionized ammonia impairment will be addressed by reductions in total ammonia. The total ammonia TMDL is an in-stream concentration of 0.32 mg/L and is allocated as follows. The in-stream un-ionized ammonia concentrations must meet the water quality criterion, which requires a 33.3 percent reduction of total ammonia at sources contributing to exceedances.

## Methods

Surface water samples were collected to determine the health of Munson Slough and met the requirements of the Florida Department of Environmental Protection (FDEP).

## Results

Due to drought, several stations were dry or “puddled” during the sampling period. When viewing tables and figures, the absence of data mean there was not enough data collected (due to lack of water or in the case of Station MS2, activities related to the Lake Munson Dam project) to fulfill data requirements. FDEP’s current numeric nutrient data requirements state “that there shall be at least four temporally independent samples per year. . . .”. Due to low water conditions, four temporally independent samples per year could not be collected from stations during some years.

## Nutrients

According to FDEP requirements, Numeric Nutrient Criteria (NNC) (expressed as an annual geometric mean) cannot be exceeded more than once in a three year period. The nutrient thresholds and results are found in Table 1.

**Table1.** FDEP’s total nitrogen criteria for streams applied to Munson Slough. Results in bold signify exceedances of the State criteria.

Munson Slough	Instream Protection Criteria				
	TN (1.03 mg/L)				
Year	MS1	MS2	MS3	MS4	MS5
2006	0.75	<b>1.44</b>	<b>1.32</b>	<b>1.43</b>	-
2007	<b>1.36</b>	<b>1.59</b>	-	-	-
2008	0.89	0.73	-	-	0.87
2009	0.62	0.73	0.74	-	-
2010	<b>1.09</b>	<b>1.35</b>	-	<b>1.35</b>	<b>1.14</b>
2011	0.80	-	-	-	-
2012	0.90	-		1.02	-
2013	<b>1.27</b>	-			

**Table1.** FDEP’s total phosphorus criteria for streams applied to Munson Slough. Results in bold signify exceedances of the State criteria.

Munson Slough	Instream Protection Criteria				
	TP (0.18 mg/L)				
Year	MS1	MS2	MS3	MS4	MS5
2006	0.16	<b>0.24</b>	<b>0.19</b>	<b>0.22</b>	-
2007	<b>0.21</b>	<b>0.28</b>	-	-	-
2008	0.12	<b>0.25</b>	-	-	<b>0.28</b>
2009	0.11	0.18	0.18	-	-
2010	0.13	0.16	-	0.17	0.18
2011	0.11	-	-	-	-
2012	<b>0.20</b>	-	-	0.17	-
2013	0.17	-	-	-	-

The Munson Slough total nitrogen and phosphorus levels exceeded the NNC at all stations during the period of record. Both nutrients remain above the TMDL limit (Figures 1 and 2). During the February 2013 sampling event, the station MS2 nitrogen (10.2 mg/mL) and total phosphorus (1.1 mg/mL) levels were the highest on record for Munson Slough.

Ammonia levels continue to be elevated (Figure 3), with the latest exceedance occurring during the October 2012 sampling event at Station MS2 (2.5 mg/L).

Since the Munson Slough watershed is heavily urbanized, and the Slough itself significantly altered over the years, there are several reasons why there are elevated nutrients in this system. Urban runoff tends to have high nutrient loads due to fertilizers, lawn clippings, sediments, animal droppings, sewer overflows, etc.

## *Fecal Coliforms*

While there have been historic exceedances of the fecal coliform criteria, fecal coliforms did not exceed the state criteria in 2013 (Figure 4).

## *Dissolved Oxygen (DO) and Chlorophyll *a**

Interestingly enough, FDEP's new DO criterion shows very few results that did not meet the threshold (Figure 5). However, this does not in any way invalidate the TMDL. Algal blooms, represented by chlorophyll *a* (Figure 6) can produce large amounts of oxygen during daylight hours via photosynthesis. Conversely, during nighttime hours, respiration occurs and algal blooms remove DO from the water, which may lead to little or no oxygen in the water column. The chlorophyll *a* result (503 µg/L) from Station MS2 during the February 2013 sampling event is highest chlorophyll *a* value recorded from any Leon County water quality station.

## *Biological Oxygen Demand (BOD)*

Elevated BOD levels (Figure 7) during some sampling events showed that elevated microbiological activity may be contributing to changes in DO. The microbial activity appears to have been stimulated by elevated levels of nitrogen and phosphorus.

## *Metals*

Both Munson Slough and Lake Munson exceeded Class III water quality criteria for lead several times in 2013. Relict anthropogenic sources such as leaded gasoline are most likely to be the cause of these exceedances.

[Click here for more information on metal levels in Leon County waterbodies.](#)

## *Turbidity*

Turbidity levels at Stations MS2 (176 NTU) and MS4 (82 NTU) exceeded Class III water quality standards during the February 2013 sampling event, probably as a result of the algal bloom occurring at the same time.

## **Conclusions**

Based on ongoing sampling, Munson Slough does not meet the nutrient thresholds for the East Panhandle Region. Nitrogen, phosphorus and ammonia levels remain above the TMDL limit. During the February 2013 sampling event, station MS2 nitrogen and total phosphorus levels were the highest on record.

While there have been historic exceedances of the fecal coliform criteria, fecal coliforms did not exceed the state criteria in 2013.

Interestingly enough, FDEP's new DO criterion shows very few results that did not meet the threshold. However, this does not in any way invalidate the TMDL. Algal blooms, represented by chlorophyll *a* can produce large amounts of oxygen during daylight hours via photosynthesis. Conversely, during nighttime hours, respiration occurs and algal blooms remove DO from the water, which may lead to little or no oxygen in the water column.

Elevated BOD levels during some sampling events showed that elevated microbiological activity may be contributing to changes in DO. The microbial activity appears to have been stimulated by elevated levels of nitrogen and phosphorus

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Turbidity levels at Stations MS2 and MS4 exceeded Class III water quality standards during the February 2013 sampling event, probably as a result of the algal bloom occurring at the same time.

Since the Munson Slough watershed is heavily urbanized and the Slough itself significantly altered over the years, there are several reasons why there are elevated nutrients in this system. Urban runoff

tends to have high nutrient loads due to fertilizers, lawn clippings, sediments, animal droppings, sewer overflows, etc. While the County and the City of Tallahassee have made strides in reducing non-point source pollution (various stormwater facilities in the City and County, etc.), work will need to continue to further improve water quality in this system.

Thank you for your interest in maintaining the quality of Leon County's water resources. Please feel free to contact us if you have any questions.

**Contact and resources for more information**

[www.LeonCountyFL.gov/WaterResources](http://www.LeonCountyFL.gov/WaterResources)

[Click here to access the results for all water quality stations sampled in 2013.](#)

Johnny Richardson, Water Resource Scientist  
(850) 606-1500  
[Richardsonjo@leoncountyfl.gov](mailto:Richardsonjo@leoncountyfl.gov)

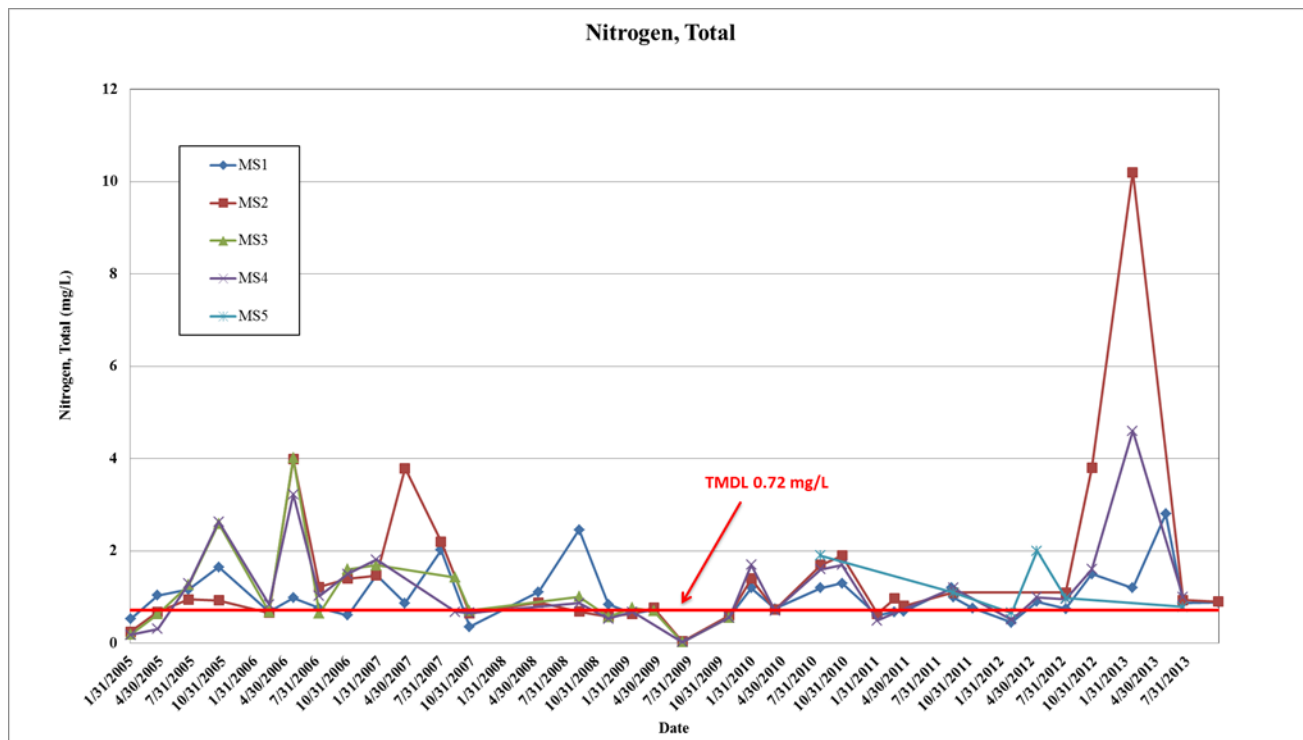


Figure 1. Total nitrogen results for Munson Slough.

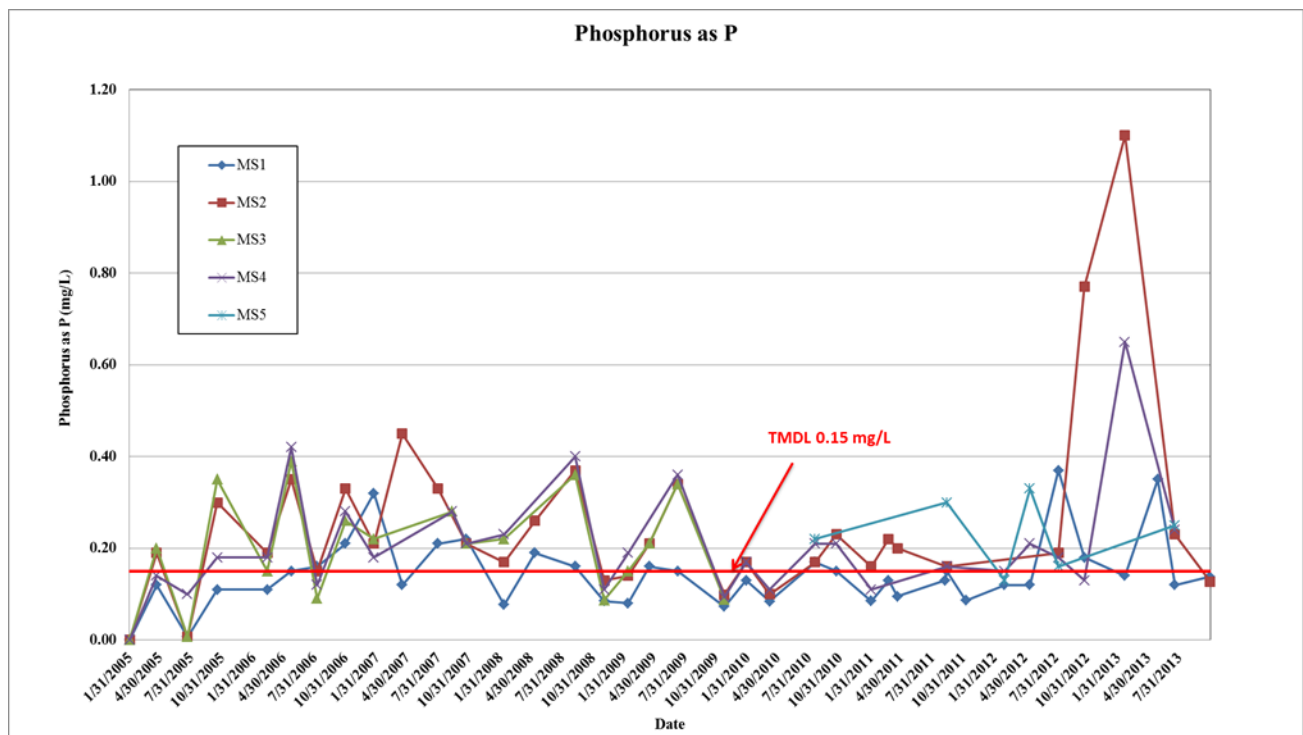


Figure 2. Total phosphorus results for Munson Slough.

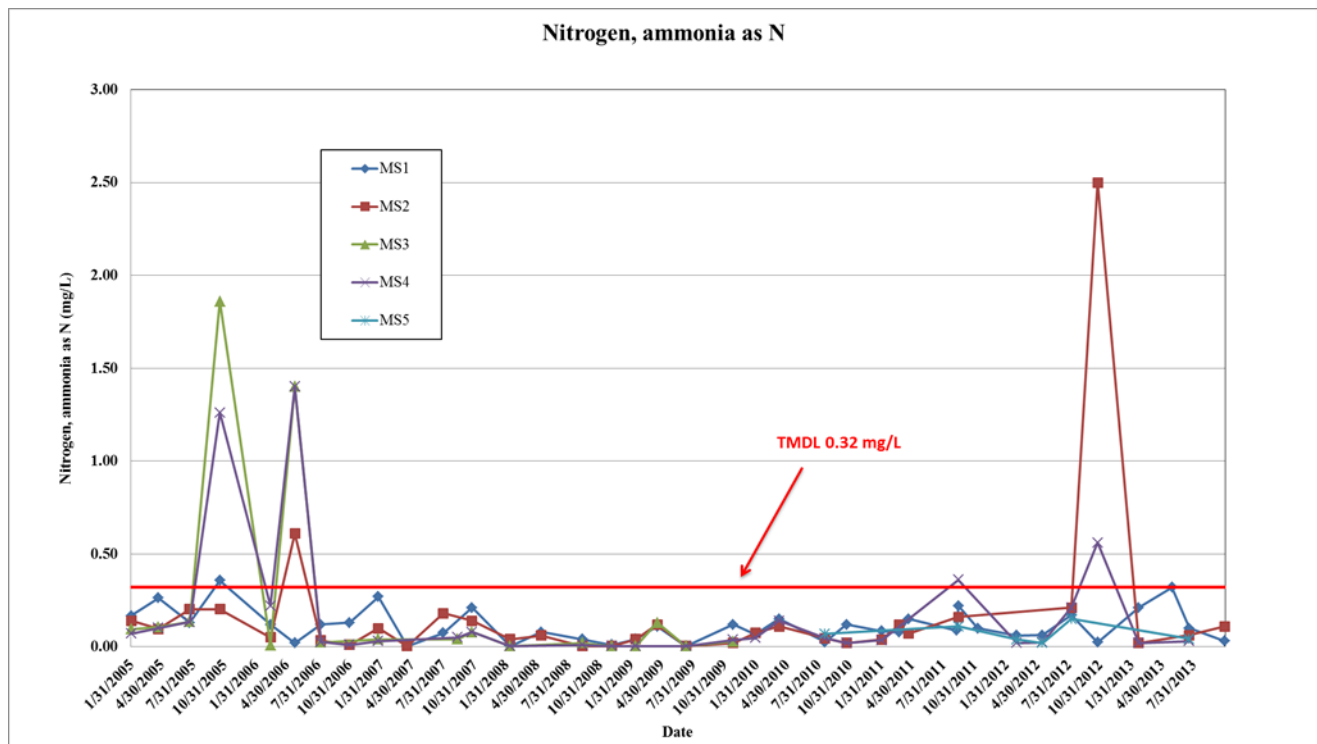


Figure 3. Ammonia as N results for Munson Slough.

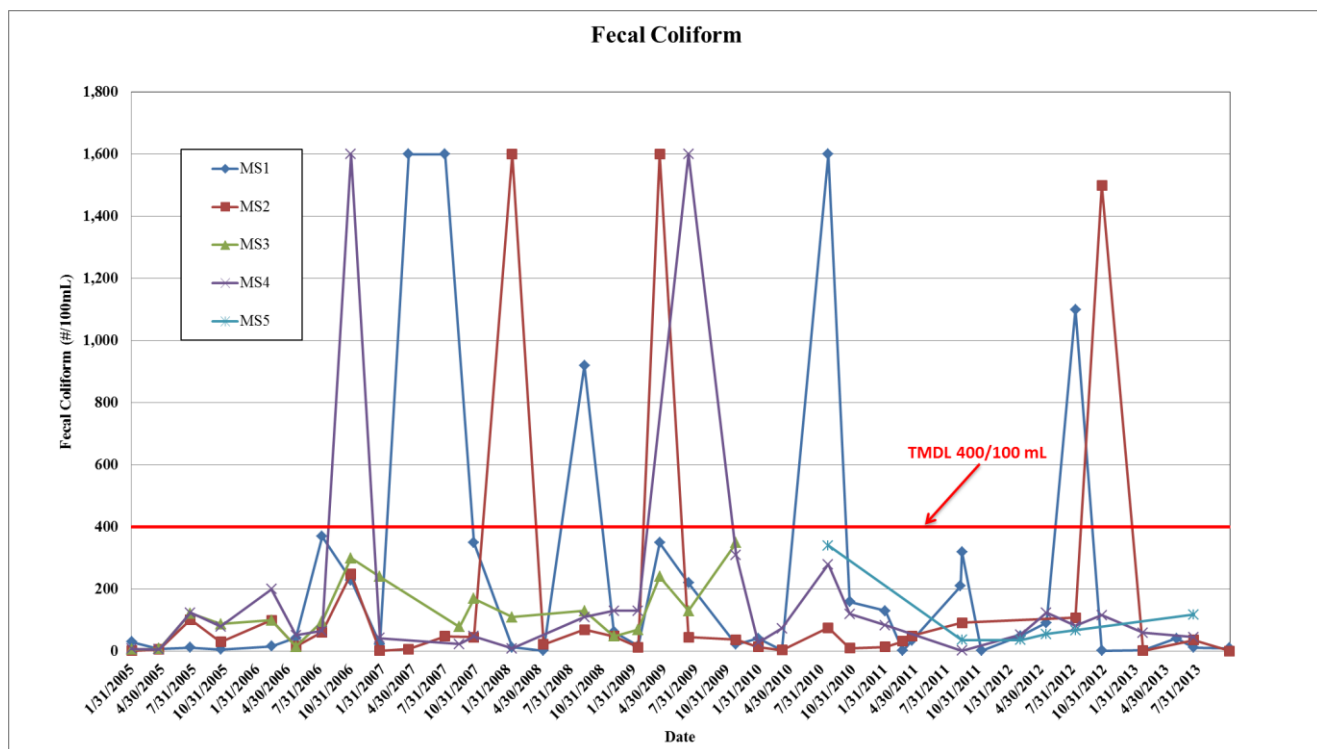


Figure 4. Fecal coliform results for Munson Slough.

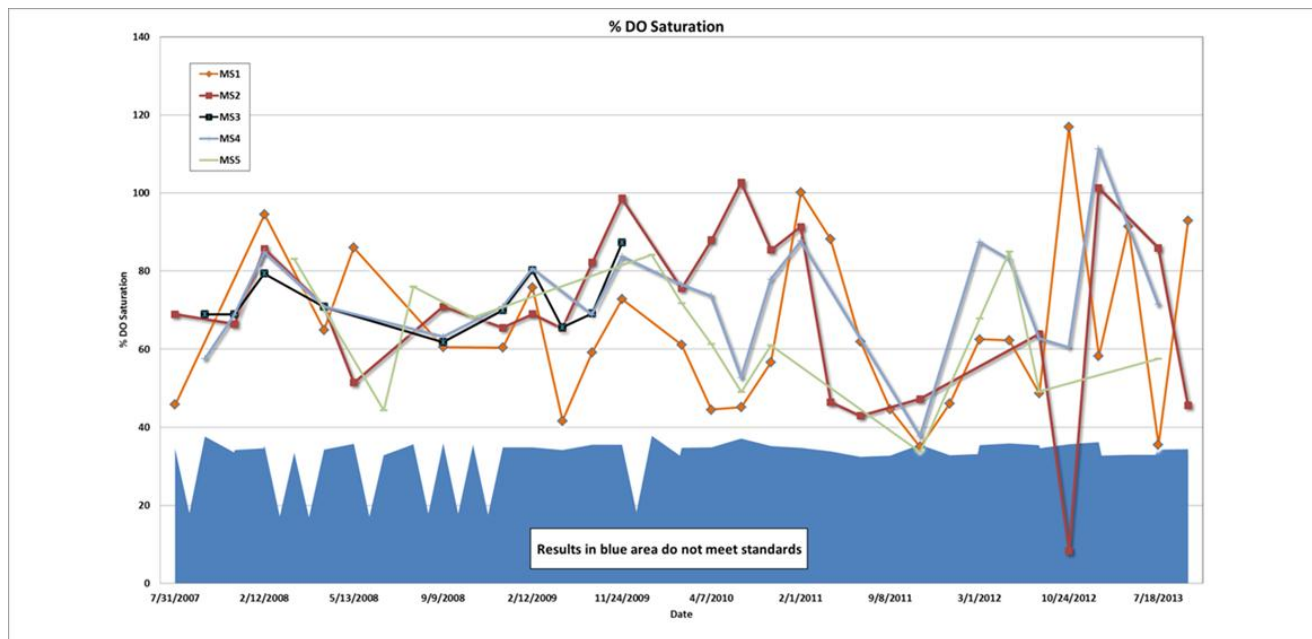


Figure 5. Dissolved Oxygen Percent Saturation results for Munson Slough.

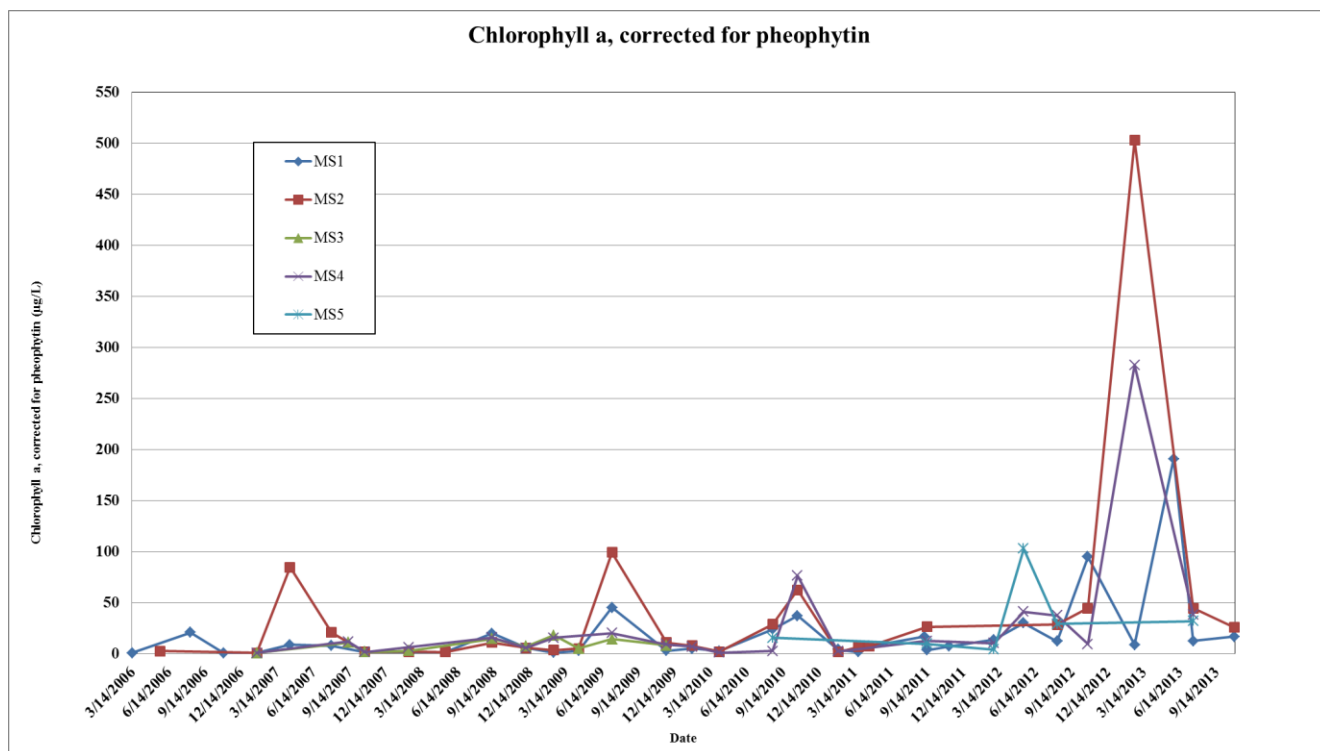
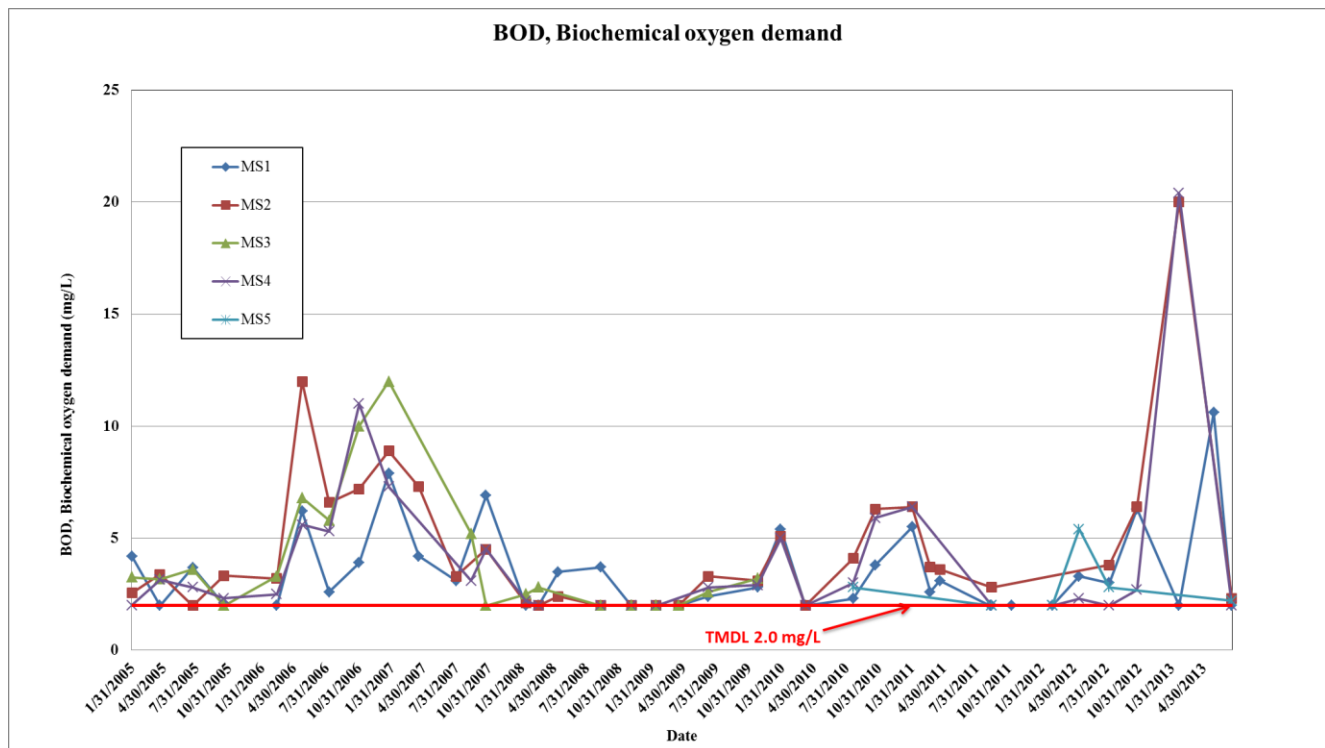


Figure 6. Chlorophyll a results for Munson Slough.



**Figure 7.** Biological Oxygen Demand results for Munson Slough.